Management Measurement Scale As A Reference To Determine Interval In A Variable

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Abstract

The scale is usually used to check and determine the value of a qualitative factor in quantitative measures. The measurement scale is a management in agreement that is used as a reference to determine the short length of the interval that is in the measuring instrument, so that the measuring instrument when used in measurements will produce quantitative data. The results of the scale management calculation must be interpreted carefully because in addition to producing a rough picture, the respondent's answers are not just straightforward to be trusted. Types of measurement scales: Likert scale, Guttman scale, semantic differential scale, rating scale, Thurstone scale, Borgadus scale, and various other measurement management scales. One of the most difficult jobs for information technology researchers faced with the necessity of measuring variables is: finding directions in the midst of many existing sizes. If there is a good size for a particular variable, it seems that there are not many reasons to compile a new size yourself.

Keywords*: Scale, Measurement, Variables.*

1. Introduction

The scale is usually used to check and determine the value of a qualitative factor in quantitative measures. Scale is a tool that is compiled and used by researchers to change the response about a qualitative variable to quantitative data (Mahmud, 2011: 181) [1]. To support the content of the arguments in the paper, additional information and facts are needed as one side of the management of the power of an argument [2]. In measurement, variables that are caustive are nominal in scale, while quantitative variables are ordinal, interval or ratio. Through this change, nominal scale variables are converted into interval scale variables. So in the context of research, the use of scale instruments is intended to capture interval-scale data (Muhammad Ali, 2009) [3].

The results of scale management must be interpreted with caution because in addition to producing a rough picture, the respondent's answers are not just straightforwardly reliable. Bergman and Siegel in Arikunto (2010) specify the things that affect respondents' dishonesty, namely friendship, guessing speed, speed in deciding, first impression answers, instrument appearance, prejudice, hallo effects, average making mistakes and generosity [4] . The use of scale management instruments is aimed at the management of data collection related to the emotional aspects of the object of research.

2. Research Method

The measurement scale is an agreement management that is used as a reference to determine the short length of the interval that is in the measuring instrument, so that the measuring instrument when used in the measurement will produce quantitative data. Statistical

data is closely related to the results of the measurement scale management used. Based on the measurement management level, statistical data can be sorted into four types, namely nominal scale data, ordinal scale data, interval scale data, and scale ratio data (Partino & Idrus, 2009: 7) [5]. The simplest form of measurement involves categorizing cases based on the presence or absence of several attributes or properties (Diekhoff, 2005) [6].

There are four types of measurement scales, namely: Nominal Scale, Ordinal Scale; Interval Scale; and Scale Ratio. From the measurement management scale, nominal data, ordinal data, interval data, and data ratios will be obtained. The next description is as follows (Riduwan, 2005) [7]:

1. Nominal Scale

The nominal scale, which is the simplest scale in measurement management, is arranged by type (category) or number function only as a symbol to distinguish a characteristic from other characteristics. The characteristics of nominal scale management include (Sunyoto, 2011: 48) [8]: the position of data is equivalent, and mathematical operations cannot be performed such as addition, subtraction, division, and multiplication.
Examples of actual nominal data:

a) Skin Type: Black ❶, Yellow ❷, White ❸. Numbers ❶, ❷, ❸, only as labels.
b) Regional Tribes: Jawa ❶, Madura ❷, Bugis ❸, Sunda ❹, Batak ❺.
c) Religion: Islam ❶, Christian ❷, Hindu ❸, Buddhism ha, others

2. Ordinal Scale

An ordinal scale is a scale based on ranking, sorted from a higher level to the lowest level or vice versa. So the ordinal scale makes it possible to do a management to sort a person or object according to the quantity or characteristics of it (Kusaeri & Suprananto, 2012) [9].
Example.

1) Measuring class rankings: I, II, III
2) Measuring championships for example Indonesian League Champions in 1995: Persib ❶, Petrokimia Gresik ❷, and Pupuk Kaltim ❸.
3) Exemplary: level ❶, level ❷, level ❸, and level ❹.
4) Military rank. For example: General ❹, Lieutenant General ❸, Major General ❷, and Brigadier General ❶.

3. Interval Scale

Interval scale has characteristics such as those owned by nominal and ordinal scales with added other characteristics, namely in the form of a fixed interval. Thus researchers can see the magnitude of the differences in characteristics between one individual or object and another (Juliansyah, 2011: 127) [10]. The interval scale is a scale that shows the distance between one data and another and has the same weight. The interval measurement scale is really a number for arithmetic operations.

Example:
1) College exam scores: A, B, C, D, and E.
2) IQ score, EQ score, and SQ score
3) Time: minute, hour, day, week, month, year.
4) Sort: Quality of Service, State of perception of employees, and Attitude of the Leader.

Very Satisfied	❺	Satisfied	❹
Satisfied	❸	Dissatisfied	❷
Dissatisfied	❶		

4. Ratio Scale

The ratio scale has all the characteristics that are owned by the nominal, ordinal scale, and the intervals with excess scale management have absolute 0 (zero) empirical values. This zero absolute value occurs when a characteristic being measured does not exist. The ratio scale is a measurement management scale that has an absolute zero value and has the same distance [11]. Thus management with ratio scale data is data obtained by measuring where the distance of two points on the scale is known.

For example, human age and the scale of both scales do not have negative zeros. This means that a person cannot be under zero years of age and someone must have considerations above zero as well. For interval data we can say that a person who is 50 years old is twice the age of a young person aged 25 years, so someone who is 20 years old is half of the age of 40 years. Other examples are weight, tree height, human height, distance, length and so on.

3. Results and Analysis

The development of computer science and information technology, the research instrument will emphasize management on attitude measurement, which uses attitude scales [12]. The scale forms of attitude that need to be known in conducting research. There are 7 types of attitudes that are often used, namely: Likert scale, Guttman scale, semantic differential scale, rating scale (rating scale), Borgadus scale, sociometric scale, and Thurstone scale. The seven types of scale when used in measurements, will get interval or ratio data. This will depend on the field to be measured, for example in the field of education [13].

1. Likert Scale

Likert scale is used in the management of measuring attitudes, opinions and perceptions of a person or group about social events or symptoms. In research social phenomena have been specifically determined by researchers, which are hereinafter referred to as research variables [14]. By using a Likert scale, the variables to be measured are translated into dimensions, dimensions are translated into sub-variables, then sub-variables are further translated into measurable indicators. Finally these measurable indicators can be used as a starting point for making instrument items in the form of questions or statements that need to be answered by respondents. Each answer is related to the form of statement or attitude support expressed in the following words:

- Very High / Very Important / Very True ❺
- High / Important / True ❹
- Quite High / Quite Important / Quite Correct ❸
- Low / Less Important / False ❷
- Low / Not Important / Very False ❶

Table 1. Practical example: a checklist form statement

NO	Statement	Alternative Answers				
		❺	❹	❸	❷	❶
		SA	A	N	D	SD
1.	Guidelines for making the organizational structure of the School Board have been socialized.	✓				
2.	The World of Education has data on a number of schools that already have the School Board organizational structure.		✓			

Information:

Strongly Agree	(SA)	= ❺
Agree	(A)	= ❹
Neutral	(N)	= ❸
Disagree	(D)	= ❷

Strongly Disagree (SD) = ❶

In relation to the questionnaire data collection technique, the instrument was distributed to 70 respondents, then recapitated. From the data of 70 respondents.

For example: Answering ❺ = 2 people
Answer ❹ = 8 people
Answer ❸ = 15 people
Answer ❷ = 25 people
Answer ❶ = 20 people.

- Calculate scores by:

The total score for 2 people answered ❺ : 2 x 5 = 10
Total score for 8 people answered ❹ : 8 x 4 = 32
Total score for 15 people answered ❸ : 15 x 3 = 45
The total score for 25 people answered ❷ : 25 x 2 = 50
Total score for 20 people answered ❶ : 20 x 1 = 20
Amount = 157

The ideal number of scores for item No.1 (highest score) = 5 x 70 = 350 (SA)
Jumlah skor rendah = 1 x 70 = 70 (SD)

Based on data (item no. 1) which was obtained from 70 respondents, the socialization of guidelines for making School organizational structures was located in the Neutral area. So, based on data (item No. 1) obtained from 70 respondents, the socialization of guidelines for making the School Board organizational structure, namely: 157/350 x 100% = 44.86% classified as sufficient.

Likert scale also has several weaknesses, among others (Nazir, 2005: 340): 1) because the size used is an ordinal measure, the Likert scale can only rank individuals on a scale, but cannot compare the number of times an individual is better than another individual ; and 2) sometimes the total score of an individual does not give a clear meaning, because many response patterns for some items will give the same score. The validity of the Likert scale is a question that still requires empirical research.

2. Guttman Scale

The Guttman scale is a cumulative scale. The Guttman scale measures only a dimension of a multidimensional variable. The Guttman scale is also called the scalogram scale which is very good for convincing researchers about the unity of dimensions of the attitudes or traits studied, which are often called universal attributes. On the Guttman scale there are several questions that are hierarchically sorted to see a person's particular attitude. If someone states no to certain attitude questions from a series of statements, he will state more than nothing to the next statement (Sekaran, 2006) [15].

There are two main weaknesses of the Guttman scale, namely: 1) the Guttman scale can not be an effective basis for measuring attitudes towards complex objects or for making predictions about the behavior of the object; and 2) one scale may have a single dimension for one group but double for another group, or dimension one for one time and has a double dimension for another time with the same respondent.

So, the Guttman Scale is the scale used to answer clear and consistent ones. For example: sure - not sure; Yes No; True False; positive - negative; never - never; agree - disagree. And so forth. The data obtained can be in the form of interval data or dichotomy ratio (two different alternatives). The study uses the Guttman scale if you want to get clear answers and be consistent with a problem being asked.

Example:

- Are you sure or not, the change of president will be able to overcome the nation's problems:
  a. Sure
  b. No
- What is your comment, if Gusdur leaves the presidency?
  a. Agree

b. Disagree

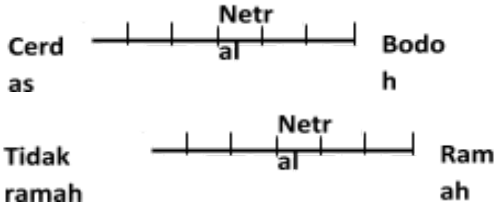
The Guttman scale can also be made a multiple choice form and can also be made in the form of a checklist. The respondent's answer can be the highest score worth (1) and the lowest score (0). For example: for Correct (1) and False (0) answers. Analysis was carried out as on a Likert scale.

3. Semantic Defferensial Scale

This scale was developed by Charles Osgood and Tannenbaum in 1957. Respondents were asked to give an assessment of a particular concept or object (Usman & Akbar, 2003: 71) [16].

The semantic differential scale or the scale of the semantic difference contains a series of characteristics of bipolar (two kutup), such as: heat - cold; popular - not popular; good - not good and so on. The bipolar characteristic has three basic dimensions of one's attitude towards objects, namely [17]: 1) potential, namely the strength or physical attraction of an object; 2) evaluation, namely things that benefit or do not benefit an object; and 3) activity, namely the level of movement of an object.

Example:

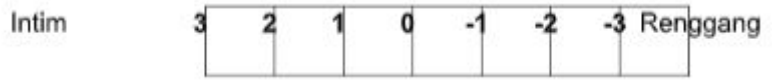


From the example above, the respondent gives a sign (X) to the value that corresponds to his perception. Social researchers can use the scale of semantic differences in various ways. For example: determining the strength of candidate politicians among voters, giving an assessment of one's personality, assessing the nature of interpersonal relationships in the organization, and assessing one's perceptions of interesting social or personal objects from various dimensions. Besides that on the scale of semantic differences, respondents were asked to answer or give an assessment of a particular concept or object [18].

For example employee performance, leadership role, leadership style, work procedures, work productivity, teacher activities in the classroom, control and support of parents for their children, and so on. This scale shows a contradictory state, for example tight - loose, often done - never done, weak - strong, positive - negative, bad - good, bad - good, active - passive, big - small and so on.

Example: give a sign (✓) on the scale that best suits you:

- Give a cross (X). relationship between fellow Admin Training participants in one class, as follows:



4. Rating Scale

On a rating scale, the assessor assigns a number to a continuum where the individual or object will be placed [19]. The appraiser consists of several people and these assessors are people who know the field being assessed. Based on the 3 measurement scales, namely: Likert Scale, Guttman Scale, and Semantic Difference Scale, the data obtained are quantitative qualitative data. While rating scale, which is raw data obtained in the form of numbers and then interpreted in a qualitative sense [20]. Respondents answered, for example: strict - loose, often done - never done, weak - strong, bad - good, akif - passive, big - small, these are all examples of qualitative data.

Making and compiling instruments using a rating scale that is important must interpret or interpret each number given in the alternative answers to each instrument item.

Example:
The researcher wanted to know how harmonious the relationship between husband and wife to create a prosperous family. Give a circle (•) to the number provided:

Table 2. Scale of Assessment Statement About Creating a Prosperous Family

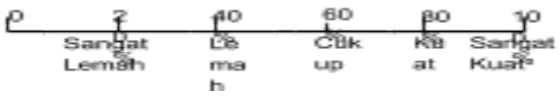
No. Item	Pernyataan Tentang Menciptakan Keluarga Sejahtera	Interval Jawaban				
		SB	B	CB	KB	STB
		❺	❹	❸	❷	❶
1.	Masalah Agama	❺	4	3	2	1
2.	Manajemen pendidikan anak	5	❹	3	2	1
3.	Pengaturan keuangan keluarga	5	4	❸	2	1
4.	Perwujudan kasih saying	5	4	3	❷	1
5.	Masalah rekreasi	5	4	3	2	❶
6.	Memilih sahabat-sahabat	❺	4	3	2	1
7.	Aturan rumah tangga	5	4	3	❷	1
8.	Adat kebiasaan	❺	4	3	2	1
9.	Pandangan hipup	5	4	3	❷	1
10.	Cara bergaul dengan keluarga saudara	5	❹	3	2	1
11.	Pekerjaan istri	5	4	❸	2	1
12.	Keintiman hubungan suami istri	❺	4	3	2	1
13.	Pemeliharaan anak	5	❹	3	2	1
14.	Pembagian tugas rumah tangga	5	4	3	❷	1

If the instrument is used as a questionnaire then distributed to 25 respondents, before being analyzed, the recapit is as follows: Number of score criteria (if each item gets the highest score), namely: = (highest score of each item = 5) x (number of items = 14) x (number respondent = 25) is 1750.

Table 3. Answers of 25 respondents about Creating a Sakinah Family

No. Responden	Jawaban responden untuk item nomor ke-														Jumlah
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1.	5	5	2	5	3	3	5	2	5	2	5	5	5	3	55
2.	5	4	4	4	4	4	5	5	5	5	5	4	4	4	62
3.	5	3	3	3	3	4	4	4	5	5	5	5	5	5	69
dst....															dst.....
23.	5	5	5	5	5	4	4	5	5	5	5	5	5	5	68
24.	5	3	3	3	3	5	5	5	5	5	5	5	5	5	62
25.	4	4	4	4	4	4	5	5	5	5	5	3	3	5	60
Jumlah Skor Hasil Pengumpulan Data															1400

If the number of scores from the data collection = 1400. Thus the harmonious relationship between husband and wife to create a prosperous family, according to the perception of 25 respondents, namely: 1400: 1750 x 100% = 80% of the criteria set. If the interpretation of the value of 80% lies in the Strong area, while the value of 1400 is included in the good interval category. Continuum can be made as follows:



5. Thurstone Scale

The Thurstone scale asks respondents to choose questions that they agree on from several questions that present different views. In general, each item has a value association

between 1 and 10, but the values are unknown to the respondent. Giving this value is based on a certain number of questions chosen by respondents regarding the questionnaire [21]. The difference between the thurstone scale and the Likert scale is that on the thurstone scale the same length has the same strength intensity, whereas the Likert scale does not need to be the same.

Example:

Recruit Candidates for Mathematics Education Lecturers. Please choose 5 of the 10 statements that match your perception:

a) I chose a job as a lecturer because of noble and honorable work to develop knowledge.
b) If I am a Computer Systems student, I would propose that Computer System students use certain symbols to be proud of.
c) I feel honored if I have more ability to teach something than to master the field of study.
d) What can be proud of by a lecturer; if the salary is just mediocre, think of teaching to walk, on campus often face the task of working with complicated problems and stubborn students, etc.
e) Glad to be a lecturer if you successfully demonstrated lessons to students who faced difficulties in the laboratory.
f) As a lecturer, I am proud because the lecturer is the heir of a scientist who teaches students to be prepared to be strong, quality, creative, and professional human beings to fill the nation's development.
g) Lecturer salaries should be greater than the salaries of other employees.

Based on the statement of the item above, it can be analyzed in the following ways:

(1) The researcher gives an accurate answer key and assessment.

No. item statement	1	2	3	4	5	6	7	8	9	10
Score	10	7	6	2	8	9	4	3	5	1
The highest score : 6 + 7 + 8 + 9 + 10 = 14 40 : 5 = 8 Lowest value : 1 + 2 + 3 + 4 + 5 = 15 15 : 5 = 3										

(2) Give value according to the respondent's answer and calculate the results of the respondent's data recapitulation.

For example: Fathimathus Sholihah (respondent's name) answers:

No. item statement	1	2	3	4	5	6	7	8	9	10	
Respondent's answer	❶	❷	❸	-	❹	❺	-	-	-	-	
Score	10	7	6	-	8	9	-	-	-	-	∑ = 40
Calculation: 10 + 7 + 6 + 8 + 9 = 40 Score : 40 : 5 = 8											
Conclusion: The value of 8 from Fathimathus Sholihah is having a high response to becoming a lecturer.											

6. Borgadus Scale

Bogardus Scale is a scale for measuring social distance developed by Emory S. Bogardus. What is meant by social distance is the degree of understanding or intimacy and kekariban as a characteristic of general social relations whose continuum consists of "very close", "close", "indifferent", "hate", to "reject altogether" (Nazir, 2005 : 329) [22]. In making this scale of social distance, a high score is given to high quality.

Bogardus scale was originally made to see the degree of willingness to accept Negroes. The application can be made for other sizes. For example, we want to see how some tribes accept Javanese people. In the list of questions a question is made as follows:

Do you?

a. Do you want to accept Javanese to marry your relatives? ----
b. Do you want to accept Javanese as your thick friend? ----
c. Do you want to accept Javanese people working together with you? ----
d. Do you want to accept Javanese in one organization with you? ----

e. Want to accept Javanese as your villagers? ----
f. Want to accept your Javanese leader? ----

It needs to be reminded that in compiling the above questions, the order of quality must be clear, where the gradation decreases significantly, from "high acceptance" to "low acceptance". The above questions are given a score of 1 for answers f to 6 for answers a. Those who answer b are given a score of 5 and those who answer e are given a score of 2. It can also be felt that those who answer a will receive all other answers (accepting b, c, d, and f). Those who receive questions d, will receive questions e and f, but do not accept a, b, c. In other words, the questions on the Bogardus scale are arranged by rank, from high to low.

For example the above question was asked to a number of respondents consisting of three tribes, namely Aceh, Batak, and Bugis. Then the presentation from respondents who answered "yes" was calculated for each level of social distance above. Respondents' answers are tabulated as shown in table 1.4.

Table 4. Responsiveness of Respondents Against Acceptance of Foreigners.

Skor	Distance of acceptance	Acehnese (%)	Batak tribe (%)	Bugis tribe (%)
6	Marry with relatives	90	45	12
5	As a thick friend	92	60	21
4	Work together	95	75	35
3	Organizational friend	94	77	50
2	As a villager	95	86	55
1	As leader	5	7	20

The way to make a Bogardus scale is: 1) multiplying the score by presentation in the matrix cell; 2) add the multiplication results for each tribe; and 3) the sum of the results is the score for the ethnic group, and the total score is also the scale. To make a scale, work sheets can be used as follows [23].

Table 5. Work Sheet for Making Bogardus Social Distance Scale.

Skor	Aceh		Batak		Bugis	
	%	% x skor	%	% x skor	%	% x skor
5	90	450	45	225	12	60
4	92	368	60	240	21	84
3	95	285	75	225	35	105
2	94	188	77	154	50	100
1	95	95	86	86	55	55
		1.386		930		404

Table 1.5 shows that the score for Acehnese is 1,386 and for Batak people is 930. The total score for Bugis is 404. In other words, social distance in that case is placed on scale management with intervals from 404 to 1,386. In interpreting the Bogardus scale, there are two assumptions that must be accepted, namely:

1. Social distance has a certain continuum.
2. Each point on the scale has the same distance as the other points, but there is no zero.

From the second assumption, what is interpreted by the Bogardus scale is only a ranking of social distance. For example in the example above, the Acehnese have a higher scale than the Bugis in accepting Javanese. In other words, Acehnese accept Javanese more than Bugis people. However, even though the scale management for the Acehnese population shows the number 1,386 and the Bugis 404 tribe, it does not mean that the Acehnese have a degree of acceptance of the Javanese more than three times that of the Bugis. This cannot be concluded because the Bogardus scale uses interval sizes, which do not have a zero point.

4. Conclusion

Scale is a tool that is compiled and used by researchers to change the response about a qualitative variable to quantitative data. In measurement, variables that are caustive are nominal in scale, while quantitative variables are ordinal, interval or ratio. Through this change, nominal scale variables are converted into interval scale variables. So in the context of research, the use of scale instruments is intended to capture interval-scale data. The measurement scale is an agreement that is used as a reference to determine the short length of the interval that is in the measuring instrument, so that the measuring instrument when used in measurement management will produce quantitative data.

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